



STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
AIR POLLUTION CONTROL PROGRAM
205 JEFFERSON STREET, P.O. BOX 176
JEFFERSON CITY, MISSOURI 65102

EMISSIONS INVENTORY QUESTIONNAIRE (EIQ)
FORM 2.1 FUEL COMBUSTION WORKSHEET

SHADED AREAS FOR OFFICE USE ONLY

FACILITY NAME		FIPS COUNTY NO.	PLANT NO.	YEAR OF DATA	
POINT NO.	AIRS ID-PT	[1] COMBUSTION EQUIPMENT INFORMATION			
		EQUIPMENT DESCRIPTION	YEAR PUT IN SERVICE	COAL FIRING CODE NO.	MAXIMUM DESIGN RATE (MILLION BTU/HR)
SCC	SEG. NO				
COAL FIRING METHOD CODE NO. 1. TANGENTIAL 2. OPPOSED 3. FRONT 4. DRY/WET BOTTOM 5. OTHER (SPECIFY BELOW)					
		SUM OF TOTAL MAXIMUM HOURLY DESIGN RATES			
COMBUSTION EQUIPMENT USE (CHECK ONE) <input type="checkbox"/> ELECTRIC POWER GENERATION <input type="checkbox"/> INDUSTRIAL USE <input type="checkbox"/> COMMERCIAL/INSTITUTIONAL <input type="checkbox"/> SPACE HEATING <input type="checkbox"/> OTHER (SPECIFY)					
COMBUSTION EQUIPMENT CATEGORY - COAL USE ONLY (CHECK ONE) <input type="checkbox"/> PULVERIZED COAL <input type="checkbox"/> PULVERIZED COAL DRY BOTTOM <input type="checkbox"/> PULVERIZED COAL WET BOTTOM <input type="checkbox"/> CYCLONE <input type="checkbox"/> FLUIDIZED BED <input type="checkbox"/> SPREADER STOKER <input type="checkbox"/> OVERFEED STOKER <input type="checkbox"/> UNDERFEED STOKER <input type="checkbox"/> HAND FIRED <input type="checkbox"/> OTHER (SPECIFY)					
[2] FUEL INFORMATION					
FUEL TYPE (CHECK ONE ONLY)					
OIL <input type="checkbox"/> DISTILLATE (FUEL OIL 1-4) <input type="checkbox"/> RESIDUAL (FUEL OIL 5-6) <input type="checkbox"/> WASTE OIL	GAS <input type="checkbox"/> NATURAL GAS <input type="checkbox"/> LPG/PROPANE	COAL <input type="checkbox"/> ANTHRACITE <input type="checkbox"/> BITUMINOUS <input type="checkbox"/> LIGNITE	OTHER <input type="checkbox"/> REFUSE (USE FORM 2.2) <input type="checkbox"/> TRADE WASTES (USE FORM 2.2) <input type="checkbox"/> OTHER (SPECIFY)		
(USE SEPARATE PAGE FOR EACH FUEL TYPE)					
FUEL IDENTIFIER	ANNUAL THROUGHPUT	UNITS	% SULFUR BY WT AS RECEIVED *	% ASH BY WT AS RECEIVED *	HEAT CONTENT (BTU/FUEL UNIT)
FUEL TOTALS AND WEIGHTED AVERAGES					
* ATTACH A COPY OF THE CURRENT SUPPLIER STATEMENT VERIFYING PERCENTAGE OF SULFUR AND ASH CONTENTS OF THE FUEL.					
[3] CALCULATIONS OF MAXIMUM HOURLY DESIGN RATE					
CONVERT THE HEAT CONTENT UNITS FORM BTU PER FUEL UNIT TO MILLION OF BTU PER FUEL UNIT BY DIVIDING THE BTU FIGURE BY 1,000,000.					
TOTAL MAXIMUM HOURLY DESIGN RATE =					
{MAXIMUM DESIGN RATE IN MILLION BTU/HR} / {HEAT CONTENT IN MILLION BTU/FUEL UNIT}					
TOTAL MAXIMUM HOURLY DESIGN RATE					
ENTER THE TOTAL ANNUAL THROUGHPUT AND TOTAL MAXIMUM HOURLY DESIGN RATE IN BLOCK 4 OF FORM 2.0, EMISSION POINT INFORMATION FOR THIS FUEL TYPE. ENTER THE WEIGHTED AVERAGE FOR THE PERCENT ASH/SULFUR IN THE PM10/SOX BOX IN BLOCK 8 OF FORM 2.0.					

INSTRUCTIONS

FORM 2.1 FUEL COMBUSTION WORKSHEET

This form is **REQUIRED** for all facilities with on-site combustion equipment units whose total heat capacity equals or exceeds ten million BTU per hour. Facilities with smaller combustion units should use this form when grouping these combustion units. The Maximum Hourly Design Rates (MHDR) of all units, no matter what the capacity, must be reported. The MHDR calculations, including those for smaller units, must be documented. The calculations for smaller units may be displayed on Form 2.1 or on a separate sheet of paper.

A separate Form 2.0, Emission Point Information, and Form 2.1 should be completed for **each type of fuel** used (or capable to use) with the combustion equipment at this emission point **even if no annual throughput**. A **separate** Form 2.0 and Form 2.1 should also be completed for each piece of combustion equipment with a heat input capacity more than **10** million BTU per hour.

Smaller capacity BTU combustion equipment (less than 10 million BTU/hour) should be grouped together if all the equipment is within the same Source Classification Code (SCC) category. For example, two similar combustion units that both use natural gas as a fuel may be grouped.

Complete **Facility Name**, **FIPS County Number**, **Plant Number** and **Year of Data**.
See Form 1.0 instructions, page 1.0-1.

1) COMBUSTION EQUIPMENT INFORMATION

Point Number: This number is the unique identification number for each specific piece of combustion equipment. This identification number must match the point number entered on Form 1.1, Process Flow Diagram; Form 1.2, Summary of Emission Points and Form 2.0, Emission Point Information.

AIRS ID-Pt and Seg. No.: See Form 2.0 instructions.

SCC Number: List the Source Classification Code (SCC) that identifies the type of fuel unit and/or the fuel used at this emission point. An SCC is **REQUIRED** for each emission point.

Equipment Description: Please describe the combustion equipment associated with the emission point. Examples of a combustion unit include a boiler, annealing furnace, drying oven, bake oven, burn-off oven, incinerator, after burner, catalytic incinerator or thermal oxidizer.

Year Equipment Put in Service: Enter the year the combustion equipment was installed at the facility if known.

Coal Firing Code No.: This entry is required only for coal-fired combustion equipment. Enter the number corresponding to the firing method for the combustion equipment. A firing method code list is provided in Block 1 on this form.

Maximum Design Rate: This figure is the maximum hourly heat input capacity for each piece of equipment in million BTU per hour.

Sum of Total Maximum Hourly Design Rates: This figure is the total of the Maximum Design Rates for all combustion equipment.

Combustion Equipment Use: Check the box that best applies to how the combustion equipment is being used.

Combustion Equipment Category: This entry is required only for coal-fired equipment. Check the box that best applies to how the fuel is being introduced into the combustion chamber.

2) FUEL INFORMATION

Fuel Type: Check only one box for the type of combustion equipment being used. A separate Form 2.0 and Form 2.1 must be used for each different type of fuel that is being used at this emission point.

NOTE: If refuse or trade wastes are being burned, then Block 1, Equipment Information, from Form 2.2, Incinerator Worksheet, also must be completed for this emission point.

Fuel Identifier: Describe the fuel used with the combustion equipment for this emission point. Coal users must list each grade of coal used when different grades are burned.

Annual Throughput: Specify the total amount of fuel burned during the year using the combustion equipment at this emission point. The Annual Throughput figure must be expressed in the units described below.

Annual Throughput Units: The annual throughput units that apply to the combustion equipment for this emission point will depend on the SCC used. The **Annual Throughput Units MUST** correspond to the SCC Emission Factor Unit that is being used for the combustion equipment and fuel type for this emission point. The units must be expressed in tons for coal, thousands of gallons for oil or LPG, or million cubic feet for natural gas.

NOTE TO NATURAL GAS USERS: Be sure to review the comments in the Glossary regarding MMCF and MCF.

Percent Sulfur by Weight as Received: (This entry is required **ONLY** if there is a Sulfur Flag (S) accompanying the SCC used on this point. For example, there are no flags for natural gas: do not complete this entry for that fuel. However, since there are flags for propane and coal, complete this entry for those fuels.) The value for the percentage of sulfur must be entered as the weight of the sulfur in the fuel as compared with the weight of the fuel when the facility RECEIVED it. The percentage of sulfur value for coal, oil and LPG/Propane must agree with the statement from your supplier. (The default value for the sulfur content of propane is .00002%.)

If more than one shipment of the same fuel type was received and used during the year, the percentage of sulfur must be calculated as a weighted average, using the percentage sulfur and the amount of each different fuel shipment used during the year. See the Weighted Averages section for a discussion on how to calculate a weighted average on the percent sulfur.

Percent Ash by Weight as Received: (This entry is required **ONLY** if there is an Ash Flag (A) accompanying the SCC used at this point.) The value for the percentage of ash must be entered as the weight of the ash in the fuel compared with the weight of the fuel when it was

Instructions for Form 2.1
Fuel Combustion Worksheet
Continued

RECEIVED by the facility. The percentage of ash value for coal and oil must agree with the statement from your supplier. If more than one shipment of the same fuel type was received and used during the year, the percentage of ash must be calculated as a weighted average, using the percentage ash and the amount of each different fuel shipment used during the year. See the Weighted Averages section for a discussion on how to calculate a weighted average on the percent ash.

Heat Content: (See the table, "Typical Parameters of Various Fuels," at the end of the instructions for this worksheet. This table lists the Heat Content of commonly used fuels.) The value entered should be calculated as the BTU value for the specific fuel multiplied by the amount of fuel in the SCC fuel unit. The fuel units used for the Heat Content of this fuel **must agree** with Annual Throughput **SCC units** used for this fuel type. The SCC unit for coal is tons, thousands of gallons for oil or LPG, and million cubic feet (MMCF) for natural gas.

Example: For bituminous coal, multiply the heating value of 13,000 BTU/lb by 2,000 to equate the heat content to the SCC unit of tons for coal. For natural gas, multiply the heating value of 1050 BTU/SCF (standard cubic foot) by 1,000,000 to match the SCC unit of million cubic feet. For propane, multiply 94,000 BTU/gallon by 1,000 to equate heat content to the SCC unit of 1,000 gallons ($94,000 \text{ BTU/gal} \times 1,000 = 94,000,000 \text{ BTU/1,000 gallons}$).

Fuel Totals and Weighted Averages: Enter the value for the total Annual Throughput used during the year. The value for Percent Sulfur and/or Percent Ash should be entered as a weighted average(s) for the specific fuel type being used. Use the Calculation below to determine the Weighted Averages. The value entered for the Heat Content should be an average of all the heat contents.

Calculation of Weighted Average of the Percentage of Ash or Sulfur.

- A. Multiply each individual Annual Throughput of the fuel by the corresponding Percentage of Ash or Sulfur in that fuel.
- B. Total the above calculations (Throughput x Ash/Sulfur).
- C. Total all the Annual Throughputs for the specified fuel.
- D. Divide the total [Throughput x Ash/Sulfur] figure by the total annual throughput figure. The value obtained is the weighted average for the Ash/Sulfur percentage.

Instructions for Form 2.1
Fuel Combustion Worksheet
Continued

- 3) **Calculation of Maximum Hourly Design Rate:** Convert the Heat Content units from BTU/SCC Fuel Unit to Millions of BTU/SCC Fuel Unit by dividing the BTU figure by 1,000,000.

Example: During the heat content discussion, we noted that the heat content of propane is 94,000,000 BTU per 1,000 gallons. The following calculation converts to millions of BTU/SCC unit: $94,000,000 \div 1,000,000 = 94$ million BTU/ 1,000 gallons.

Total Maximum Hourly Design Rate: This entry is the amount of fuel that would be used if the combustion equipment were being continuously operated at 100 percent of its rated capacity for one hour. The Maximum Hourly Design Rate should be calculated by dividing the Total Maximum Design Rate expressed in millions of BTU per hour (MM BTU/Hr) by the Heat Content expressed in millions of BTU per fuel unit (MM BTU/fuel unit).

Example: A boiler burning propane has a total maximum design rate of 12 million BTU per hour. Using the results of the above example, the maximum hourly design rate = $12 \text{ MM BTU/hr} \div 94 \text{ MM BTU/1,000 gallons} = .1277 \text{ M gallons/hr}$.

Example: A boiler burning natural gas fuel has a Total Maximum Design Rate of 12 million BTU per hour (12 MM BTU/hr). From the heat content table, observe that the heat content of natural gas is 1,050 BTU/cubic ft (SCF). This equates to 1,050 million BTU per million cubic feet (MMCF). The Maximum Hourly Design Rate is calculated as follows:

Maximum Hourly Design Rate
= $12 \text{ MM BTU/Hr} \div 1,050 \text{ MM BTU/MM Cubic Feet (CF)}$
= $0.0114 \text{ MM CF/hour}$

The value 0.0114 MMCF per hour would then be entered in the total maximum hourly design rate box in Block 3 on Form 2.1.

ENTER THE FOLLOWING ON FORM 2.0, EMISSION POINT INFORMATION, that is associated with this Form 2.1.

- Block 4 - The Total **Annual Throughput**, Annual Throughput **Units** and the **Maximum Hourly Design Rate** should be entered in the appropriate boxes.
Block 8 - When appropriate, the weighted average values for the **Sulfur Percent** and/or the **Ash Percent** should also be entered in the appropriate box(s).

TYPICAL PARAMETERS OF VARIOUS FUELS^a

Type Of Fuel	Heating Value		Sulfur % (hy weight)	Ash % (by weight)
	kcal	Btu		
Solid Fuels				
Bituminous Coal	7,200/kg	13,000/lb	0.6-5.4	4-20
Anthracite Coal	6,810/kg	12,300/lb	0.5-1.0	7.0-16.0
Lignite (@ 35% moisture)	3,990/kg	7,200/lb	0.7	6.2
Wood (@ 40% moisture)	2,880/kg	5,200/lb	N	1-3
Bagasse (@ 50% moisture)	2,220/kg	4,000/lb	N	1-2
Bark (@ 50% moisture)	2,492/kg	4,500/lb	N	1-3 ^b
Coke, Byproduct	7,380/kg	13,300/lb	0.5-1.0	0.5-5.0
Liquid Fuels				
Residual Oil	9.98 x 10 ⁶ /m ³	150,000/gal	0.5-4.0	0.05-0.1
Distillate Oil	9.30 x 10 ⁶ /m ³	140,000/gal	0.2-1.0	N
Diesel	9.12 x 10 ⁶ /m ³	137,000/gal	0.4	N
Gasoline	8.62 x 10 ⁶ /m ³	130,000/gal	0.03-0.04	N
Kerosene	8.32 x 10 ⁶ /m ³	135,000/gal	0.02-0.05	N
Liquid Petroleum Gas	6.25 x 10 ⁶ /m ³	94,000/gal	N	N
Gaseous Fuels				
Natural Gas	9,341/m ³	1,050/SCF	N	N
Coke Oven Gas	5,249/m ³	590/SCF	0.5-2.0	N
Blast Furnace Gas	890/m ³	100/SCF	N	N

^a N = negligible.^b Ash content may be considerably higher when sand, dirt, etc., are present.